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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	39566
First Inventor	Paul D. Marko et al.
Title	Method and Apparatus for Employing Stored Content at Receivers to Improve Efficiency of Broadcast System
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☒ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☐ Applicant claims small entity status.
See 37 CFR 1.27.
3. ☒ Specification [Total Pages 15]
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross Reference to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to sequence listing, a table, or a computer program listing appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 3]
5. Oath or Declaration [Total Pages]
 - a. ☐ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 CFR 1.63 (d))
(for continuation/divisional with Box 17 completed)
 - i. ☐ **DELETION OF INVENTOR(S)**
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☐ Application Data Sheet. See 37 CFR 1.76

ADDRESS TO: Assistant Commissioner for Patents
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7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
 - a. ☐ Computer Readable Form (CRF)
 - b. Specification Sequence Listing on:
 - i. ☐ CD-ROM or CD-R (2 copies); or
 - ii. ☐ paper
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ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 CFR 3.73(b) Statement of Power of Attorney (when there is an assignee)
11. ☐ English Translation Document (if applicable)
12. ☐ Information Disclosure Statement (IDS)/PTO-1449
13. ☐ Preliminary Amendment
14. ☐ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☐ Other:

17. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP)

of prior application No. _____ / _____

Prior application information:

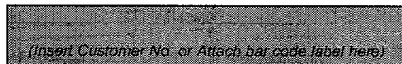
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For CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

18. CORRESPONDENCE ADDRESS

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FEE TRANSMITTAL FORM

Attorney Docket No.: **39566**

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Transmitted herewith for filing is the patent application of

Inventor: **Paul D. Marko et al.**

For: Method and Apparatus for Employing Stored Content at Receivers
to Improve Efficiency of Broadcast System Bandwidth Use

The filing fee for filing this patent application has been calculated as follows:

(Col. 1)		(Col. 2)		SMALL ENTITY		OR	OTHER THAN A SMALL ENTITY	
FOR:	NO. FILED		NO. EXTRA	RATE	FEE		RATE	FEE
BASIC FEE					\$355.00	OR		\$710.00
TOTAL	19	- 20=	0	x 9 =	\$		x 18 =	\$
INDEP	4	- 3=	0	x 39 =	\$		x 78 =	\$
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIMS				+ 130 =	\$		+ 260 =	\$
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☒ This application is being filed without oath or declaration and without the filing fee pursuant to 37 C.F.R. §1.53(f).

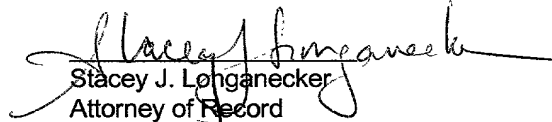
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☐ Any additional patent application processing fees under 37 CFR 1.17.

Dated: 25 October 2000


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Patent Application
of
Paul D. Marko
and
Craig P. Wadin

for

METHOD AND APPARATUS FOR EMPLOYING STORED
CONTENT AT RECEIVERS TO IMPROVE EFFICIENCY OF BROADCAST
SYSTEM BANDWIDTH USE

Cross Reference to Related Applications:

Related subject matter is disclosed and claimed in co-pending U.S. patent application of Paul D. Marko et al filed even date herewith for "Method and Apparatus for Controlling User Access and Decryption of Locally Stored Content at Receivers in a Digital Broadcast System" (attorney's file 39920); in co-pending U.S. patent application of Paul D. Marko et al filed even date herewith for "Method and Apparatus for Implementing File Transfers to Receivers in a Digital Broadcast System" (attorney's file 40554); in co-pending U.S. patent application of Paul D. Marko et al filed even date herewith for "Method and Apparatus for Prompting a Reverse Channel Response From a Receiver in a Digital Broadcast System" (attorney's file 40555); in co-pending U.S. patent application of Paul D. Marko et al filed even date herewith for "Method and Apparatus for Providing On-Demand Access of Stored Content at a Receiver in a Digital Broadcast System" (attorney's file 40557); in co-pending U.S. patent application Serial No. 09/388,926, filed by Hien D. Ma et al on November 4, 1999; and in co-pending U.S. patent application Serial No. 09/433,862, filed by Paul D. Marko et al on November 4, 1999; all of said applications being expressly incorporated herein by reference.

Field of the Invention:

The invention relates generally to an apparatus and method for reducing the bandwidth used in a digital broadcast system to provide program content to a receiver unit.

Background of the Invention:

Satellite digital audio radio service (SDARS), a satellite broadcast service established by the U.S. Federal Communications Commission (FCC), has been proposed using satellite transmission of digital audio programs to radio receivers. The radio
5 receivers can be stationary receivers (i.e., with a receiver antenna pointed for optimal line of sight (LOS) reception from a satellite) or mobile receivers (e.g., a receiver that is hand-carried by a user or is mounted in a vehicle).

The type of content which can be distributed in an SDARS system or a similar digital broadcast system typically includes audio programs such as music recordings,
10 news programs and talk shows, among other programs, and advertisements. A digital broadcast also typically comprises dialogue segments from a broadcast channel host or other program host which occur between the audio programs and advertisements presented on a broadcast channel.

A significant amount of the content that is to be broadcast is predetermined prior to transmission such as popular songs. Radio stations, for example, frequently use play
15 lists to determine how often a selected number of songs, which are identified as being most popular at a given point in time, are to be broadcast. Popular songs and other programs which can be repeated on a broadcast channel are in contrast to "live" commentary provided by a broadcast channel host, talk show host or other
20 commentator, for example.

Since bandwidth in a digital broadcast system is limited and valuable, efficient use of the bandwidth is desirable. A need therefore exists for a digital broadcast system wherein content is provided in a broadcast signal in an optimal manner to use bandwidth as efficiently as possible.

25

Summary of the Invention:

The above described disadvantage is overcome and a number of advantages are realized by a digital broadcast system wherein receivers are provided with local storage
30 devices for storing selected content (e.g., audio programs). The broadcast signal

employed by the digital broadcast system comprises dialogue segments, content segment identifiers corresponding to content that has been previously stored at the local storage devices, and control data. The receivers are configured to receive the broadcast signal and to generate an output signal for playback via a loudspeaker, for example. The output
5 signal is generated by accessing and retrieving from the local storage device those previously stored content segments identified in the broadcast signal. The retrieved segments are inserted in the output signal between the dialogue segments in accordance with the control data.

In accordance with another aspect of the present invention, the receivers are
10 provided with a processing device and a multiplexing device operable to receive control signals generated by the processing device in response to the control data and content segment identifiers provided in the received broadcast signal. The multiplexing device then assembles the output signal using the live segments in the broadcast signal and by inserting the retrieved segments from the local storage device when instructed to do so
15 via the processing device.

In accordance with yet another aspect of the present invention, the broadcast signal comprises progress information relating to the duration of the previously stored segments identified in the broadcast signal for insertion into an output signal by a receiver. The processing device is programmable to generate control signals in response
20 to the progress information to establish timing for inserting selected, stored content segments into the output signal among the live broadcast segments.

In accordance with still yet another aspect of the present invention, the content segments stored in the local storage devices can be deleted or replaced with different segments (e.g., updated versions of stored segments), and new content segments added
25 to the storage device, via different methods. For example, new content can be downloaded to the local storage device from a portable storage device, or transmitted to the local storage device via wireline or wireless communication link, as well as commands to the local storage device to delete or update previously stored segments.

In accordance with the present invention, an apparatus for generating an output
30 signal from a broadcast signal in a digital broadcast system is provided which comprises

(1) a memory device for storing predefined content segments; (2) a receiver for receiving the broadcast signal, the broadcast signal comprising content segments and control data provided among the content segments to indicate where the predefined content segments are to be inserted by the apparatus, the receiver being operable to extract the content segments and the control data from the broadcast signal; (3) an output device for playing back the output signal; (4) a processing device configured to receive the control data from the receiver and to generate a control signal used by the memory device to retrieve selected ones of the predefined content segments in accordance with the control data; and (5) a multiplexer configured to receive as inputs the control signal generated by the processing device, the content segments from the receiver and the selected predefined content segments. The multiplexer generates the output signal using the content segments received by the receiver and inserting the predefined content segments among the content segments in accordance with the control data.

15 Brief Description of Drawings:

The various aspects, advantages and novel features of the present invention will be more readily comprehended from the following detailed description when read in conjunction with the appended drawings, in which:

20 Fig. 1 illustrates an SDARS system constructed in accordance with an embodiment of the present invention;

Fig. 2 illustrates an exemplary radio broadcast transmission;

Figs. 3A, 3B and 3C illustrate, respectively, an exemplary radio broadcast transmission, stored content, and a receiver output signal generated in accordance with an embodiment of the present invention;

25 Figs. 4A, 4B, 4C and 4D relative instantaneous bandwidth requirements for an exemplary broadcast transmission and a broadcast transmission generated in accordance with the present invention; and

Fig. 5 is a block diagram of a receiver constructed in accordance with an embodiment of the present invention.

Throughout the drawing figures, like reference numerals will be understood to refer to like parts and components.

Detailed Description of the Preferred Embodiments:

- 5 Fig. 1 depicts a satellite broadcast system 10 which comprises at least one geostationary satellite 12, for example, for line of sight (LOS) satellite signal reception at receiver units indicated generally at 14. The satellite broadcast system 10 can be used for SDARS, for example. Another geostationary satellite 16 at a different orbital position is provided for diversity purposes. One or more terrestrial repeaters 17 can be provided to
- 10 repeat satellite signals from one of the satellites in geographic areas where LOS reception is obscured by tall buildings, hills and other obstructions. It is to be understood that different numbers of satellites can be used, and satellites in other types of orbits can be used. Alternatively, a broadcast signals can be sent using only a terrestrial transmission system.
- 15 As illustrated in Fig. 1, a receiver unit 14 can be configured for stationary use (e.g., on a subscriber's premises), or mobile use (e.g., portable use or mobile use in a vehicle), or both. A control center 18 is provided for telemetry, tracking and control of the satellites 12 and 16. A programming center 20 is provided to generate and transmit a
- 20 composite data stream via the satellites 12 and 16 which comprises a plurality of payload channels. One of the payload channels 30 is depicted in Fig. 2 for illustrative purposes. The system 10 can broadcast a composite data stream generated, for example, by multiplexing a plurality of payload channels 30. The receivers are therefore configured to demultiplex a received composite data stream to playback a selected one of the payload channels.
- 25 The programming center 20 is configured to obtain content from different sources and providers which can comprise both analog and digital information such as audio, video, data, program label information, auxiliary information, and so on. For example, the programming center 20 can provide SDARS having on the order of 100
- 30 different program channels to transmit different types of music programs (e.g., jazz, classical, rock, religious, country, and so on) and news programs (e.g., regional, national,

political, financial and sports). The SDARS can also provide emergency information, travel advisory information, educational programs, and the like.

The types of content to be provided in a payload channel is determined manually or automatically via a computer, based on contractual and financial arrangements with
5 information providers, and demographic and financial decisions determining the types of programming to be provided via the programming center 20. In addition, a payload channel 30 can comprise plural service components to provide a plurality of different services. For example, a number of service components in a payload channel can be related to the same service and can include an audio component and a video and/or a
10 digital data stream comprising auxiliary information, or another audio component to insert advertising information relating to the audio or video program.

With continued reference to Fig. 2, an exemplary payload channel 30 is shown which provides a radio broadcast transmission to the receivers 14. The radio broadcast transmission comprises a number of content segments corresponding to live talk 32 by a
15 program channel host (e.g., disc jockey), prerecorded commercials 34 and prerecorded musical selections 36. In accordance with the present invention, receivers 14 are configured to access and playback locally stored content segments such as prerecorded commercials 34 and musical selections 36 to reduce the amount of bandwidth required for a radio broadcast transmission, for example. The locally stored content segments can
20 include prerecorded music selections, advertisements, news programs, and the like.

With reference to Fig. 3A, a payload channel 40 is generated via the programming center 20 to transmit live talk segments 32 and data 42 which provides instructions to receivers 14 to playback selected ones of locally stored content segments. The data 42 preferably comprises identifiers for locally stored content segments and progress data.
25 When generating an output signal from the received payload channel 40, a receiver 14 uses the identifiers (e.g., "425", "007", "8", and so on) to access and retrieve corresponding content segments from a local storage device, as indicated in Fig. 3B. The receiver 14 uses the progress data to determine when to playback the retrieved content segments with respect to the broadcast live content segments 32 in the payload channel
30 40. For example, the progress data can indicate the current time index in a content

segment at a particular point in time during the transmission and playback of a payload channel. Accordingly, the progress data facilitates the generation of an output signal from the received payload channel 40 which is perceived by users as being a continuous composite data stream that was broadcast with retrieved content segments therein, as indicated in Fig. 3C.

The advantages of the present invention will now be discussed with reference to Figs. 4A through 4D. Figs. 4B and 4D contrast the instantaneous bandwidth requirements over time of the payload channels 30 and 40, respectively, in Figs. 4A and 4C. As stated previously in connection with Fig. 2, the payload channel 30 is an exemplary radio broadcast transmission. As indicated in Fig. 4B, the instantaneous bandwidth requirement varies based on the content segment. Musical selections 36 (e.g., segments "425", "007", "133", "083", "350" and "196") use significantly more bandwidth per content segment than "live" content segments 32 comprising dialogue. Prerecorded advertisements 34 generally use more instantaneous bandwidth than the "live" content segments 32 but less bandwidth than musical recordings 36. Thus, bandwidth efficiency can be increased if content segments such as musical recordings 36 can be stored at the receivers 14. The transmission bandwidth requirement to provide a musical recording to a user via a receiver 14 is therefore reduced, as evident from Fig. 4D, when a content segment index or identifier and progress data 42 is transmitted in lieu of the corresponding content segment, as shown in Fig. 4C.

Fig. 5 illustrates an exemplary receiver 14 with a local storage device 50. The local storage device 50 can be any memory device that can store information in a digital format and can include, but is not limited to, a floppy disc, a hard disk, a compact disc (CD), a digital video disc (DVD), an optical disc, random access memory (RAM), a FLASH memory, a disk pack, digital audio tape (DAT), or other medium for storage and retrieval of digital information. The local storage device 50 can be provided within a receiver 14 chassis or connected externally thereto. Selected content segments 48 are stored in the local storage device, along with associated index information (e.g., unique identifiers).

With continued reference to Fig. 5, the receiver 14 comprises an antenna 52 for receiving a broadcast signal from at least one of the satellites 12 and 16 and/or a terrestrial

repeater 17. As stated previously, the broadcast signal can originate from only a terrestrial transmission system. A converter 55 is preferably provided which is operable to perform radio frequency (RF) downconversion, and any demodulation, synchronization, demultiplexing, de-interleaving and decoding functions performed as part of the transport layer at a broadcast station in the system 10, and described in the afore-mentioned application Serial No. 09/433,862, to obtain the baseband payload channels from the broadcast composite data stream. The receiver 14 comprises a controller 60 connected to a display 64 and keypad 62 to allow a user to select a payload channel, among other operations. In response to the user program channel selection, the controller 60 provides control signals to a demultiplexer 58 to select the corresponding payload channel for output via a loudspeaker 66 or other output device (e.g., a display or monitor).

The converter 55 comprises an RF-to-audio converter 54 and an RF-to-control data converter 56 to extract, respectively, the content segments 32 and the control data 42 from a selected payload channel 40 in the received signal. The content segments 32 are preferably provided to the output device 66 via a signal multiplexer 59 as soon as they are received and processed via the converter 55 and demultiplexer 58. The extracted control data 42 is provided to the controller 60 which generates control signals for the signal multiplexer 59 and the local storage device 50. The control signals provided to the local storage device 50 indicate which of the stored content segments 48 stored in the local storage device 50 are to be accessed and retrieved in accordance with the control data. The control signals provided to the signal multiplexer 59 from the controller 60 indicate when retrieved content segments are to be provided in the output signal in accordance with the current time index provided in the control data 42 for the corresponding retrieved content segment.

The content segments 48 stored in the local storage device 50 can be updated via any of a number of different methods. For example, a broadcast signal can be provided to the controller 60 for controlling the storage device 50 to delete selected content segments stored therein, to replace selected content segments with different segments transmitted in the broadcast signal, as well as to add new segments transmitted in the broadcast signal.

Instructions for updating the storage device 50 and corresponding content segments can also be provided via an application provided on a portable storage device, or downloaded from a terrestrial communication network.

- 5 Although the present invention has been described with reference to a preferred embodiment thereof, it will be understood that the invention is not limited to the details thereof. Various modifications and substitutions will occur to those of ordinary skill in the art. All such substitutions are intended to be embraced within the scope of the invention as defined in the appended claims.

What Is Claimed Is:

1. An apparatus for generating an output signal from a broadcast signal in a digital broadcast system comprising:
 - a memory device for storing predefined content segments;
 - 5 a receiver for receiving said broadcast signal, said broadcast signal comprising content segments and control data provided among said content segments to indicate when said predefined content segments are to be inserted in said output signal by said apparatus, said receiver being operable to extract said content segments and said control data from said broadcast signal;
 - 10 an output device for playing back said output signal;
 - a processing device configured to receive said control data from said receiver and to generate a control signal used by said memory device to retrieve selected ones of said predefined content segments in accordance with said control data; and
 - a multiplexer configured to receive as inputs said control signal generated by said processing device, said content segments from said receiver and said selected predefined content segments and to generate said output signal using said content segments received by said receiver and inserting said predefined content segments among said content segments in accordance with said control data.
- 20 2. An apparatus as claimed in claim 1, wherein said memory device comprises index data with which to identify each of said predefined content segments stored therein, and said control data comprises said index data corresponding to the selected said predefined content segments, said processing device being operable to provide said index data in said control data in said control signal for retrieving said predefined content segments
25 corresponding thereto from said memory device.
3. An apparatus as claimed in claim 1, wherein said broadcast signal comprises content segment progress data for providing a time index for playing back one of said predefined content segments associated therewith, said multiplexer being controllable to
30 play back live broadcast content corresponding to received said content segments in said

broadcast signal in substantially real-time in said output signal, said receiver being operable to extract said index data and corresponding said content progress data in said broadcast signal as said broadcast signal is received, said processing device being operable to generate said control signal to instruct said multiplexer to insert selected said
5 predefined content segments among said segments of program content using said index data and said content progress data to determine when the selected said predefined content segments are to be played back as said broadcast signal is received.

4. An apparatus as claimed in claim 3, further comprising a loudspeaker with which
10 to generate an audio output signal using said live broadcast data and said selected predefined content segments inserted at selected intervals therein in accordance with said index data and said content progress data.

5. An apparatus as claimed in claim 1, wherein said processing device is
15 programmable to allow said predefined content segments in said memory device to be updated.

6. An apparatus as claimed in claim 5, wherein said receiver is operable to receive
20 broadcast content in said broadcast signal for updating said predefined content segments, and said processing device is operable to control said memory device to perform at least one of a plurality of updating operations comprising deleting selected ones of said predefined content segments, adding more predefined content segments, and substituting received said predefined content segments for previously stored ones of said predefined content segments.

25

7. A method for generating an output signal at a receiver using a broadcast signal transmitted in a digital broadcast system comprising the steps of:

storing predefined content segments in a memory device associated with said receiver;

receiving said broadcast signal at said receiver, said broadcast signal comprising segments of program content and segments of control data;

accessing and retrieving selected said predefined content segments identified by said control data from said memory device; and

5 playing back the selected said predefined content segments at selected points in said output signal in accordance with said control data.

8. A method as claimed in claim 7, wherein said memory device comprises index data with which to identify each of said predefined content segments stored therein, and
10 said control data comprises said index data corresponding to the selected said predefined content segments, said accessing step comprises the step of providing said index data in said control data to a processing device for retrieving said predefined content segments corresponding thereto from said memory device.

15 9. A method as claimed in claim 7, wherein said broadcast signal comprises content segment progress data for providing a time index for playing back one of said predefined content segments associated therewith, said playing back step comprising the steps of:

playing back live broadcast content in said broadcast signal in substantially real-time in said output signal;

20 extracting said index data and corresponding said content progress data in said broadcast signal as said broadcast signal is received; and

inserting the selected said predefined content segments among said segments of program content using said index data and said content progress data to determine when the selected said predefined content segments are to be played back as said broadcast
25 signal is received.

10. A method as claimed in claim 9, wherein playing back said output signal comprises the step of generating an audio output signal using said live broadcast data and inserting the selected said predefined content segments at selected intervals therein in
30 accordance with said index data and said content progress data.

11. A method as claimed in claim 7, further comprising the step of updating said predefined content segments in said memory device.
- 5 12. A method as claimed in claim 11, wherein said updating step comprises the step of receiving broadcast content in said broadcast signal for updating said predefined content segments.
- 10 13. A method as claimed in claim 11, wherein said updating step comprises the step of retrieving program content stored on a portable storage medium to update said predefined content segments in said memory device.
14. A transmitter in a digital broadcast system comprising:
an input device for receiving content segments;
15 a memory device for storing index data for identifying predefined content segments stored at remote locations;
a multiplexer for multiplexing selected said content segments with at least said index data to generate a broadcast signal having, said broadcast signal comprising said content segments with said index data inserted at selected being used by receiver units at
20 said remote locations to playback said content segments.
15. An apparatus for generating an output signal from a broadcast signal in a digital broadcast system comprising:
a memory device for storing content segments;
25 an output device for playing back said output signal;
a receiver for receiving said broadcast signal, said broadcast signal comprising control data to indicate which said content segments to playback via said output device and when said content segments are to be played back, said receiver being operable to extract said control data from said broadcast signal;

a processing device configured to receive said control data from said receiver, to generate a control signal used by said memory device to retrieve selected ones of said control segments in accordance with said control data, and to playback the selected said control segments substantially in real-time with respect to said broadcast signal.

5

16. An apparatus as claimed in claim 15, wherein said control data in said broadcast signal comprises segment data corresponding to each of the selected ones of said content segments for playback, said segment data for a content segment comprising progress information indicating how much of the content segment remains to be played back via said output device at any given point during the duration of the content segment for substantially real-time playback during reception of said broadcast signal.

10

17. An apparatus as claimed in claim 17, wherein said control data in said broadcast signal comprises segment data corresponding to each of the selected ones of said content segments for playback, said segment data for a content segment being transmitted in lieu of the content in the content segment to reduce bandwidth used to transmit said broadcast signal.

15

18. A apparatus as claimed in claim 17, wherein said segment data has substantially the same duration for transmission in said broadcast signal as the content in the content segment to which said segment data corresponds.

20

19. An apparatus as claimed in claim 17, wherein said segment data for a content segment comprises a content segment index used by said processing device to locate the content segment in said local storage device, and progress information indicating how much of the content segment remains to be played back, said content segment index and said progress information requiring less bandwidth for transmission in said broadcast signal than the content in the content segment.

25

Abstract Of The Disclosure

- 5 The invention relates generally to a receiver unit in a digital broadcast system for receiving a broadcast signal comprising content segments and control data, and generating an output signal using the content segments and previously stored content segments. The previously stored content segments are retrieved from a local memory device using the control data and inserted among the received content segments.

FIG. 1

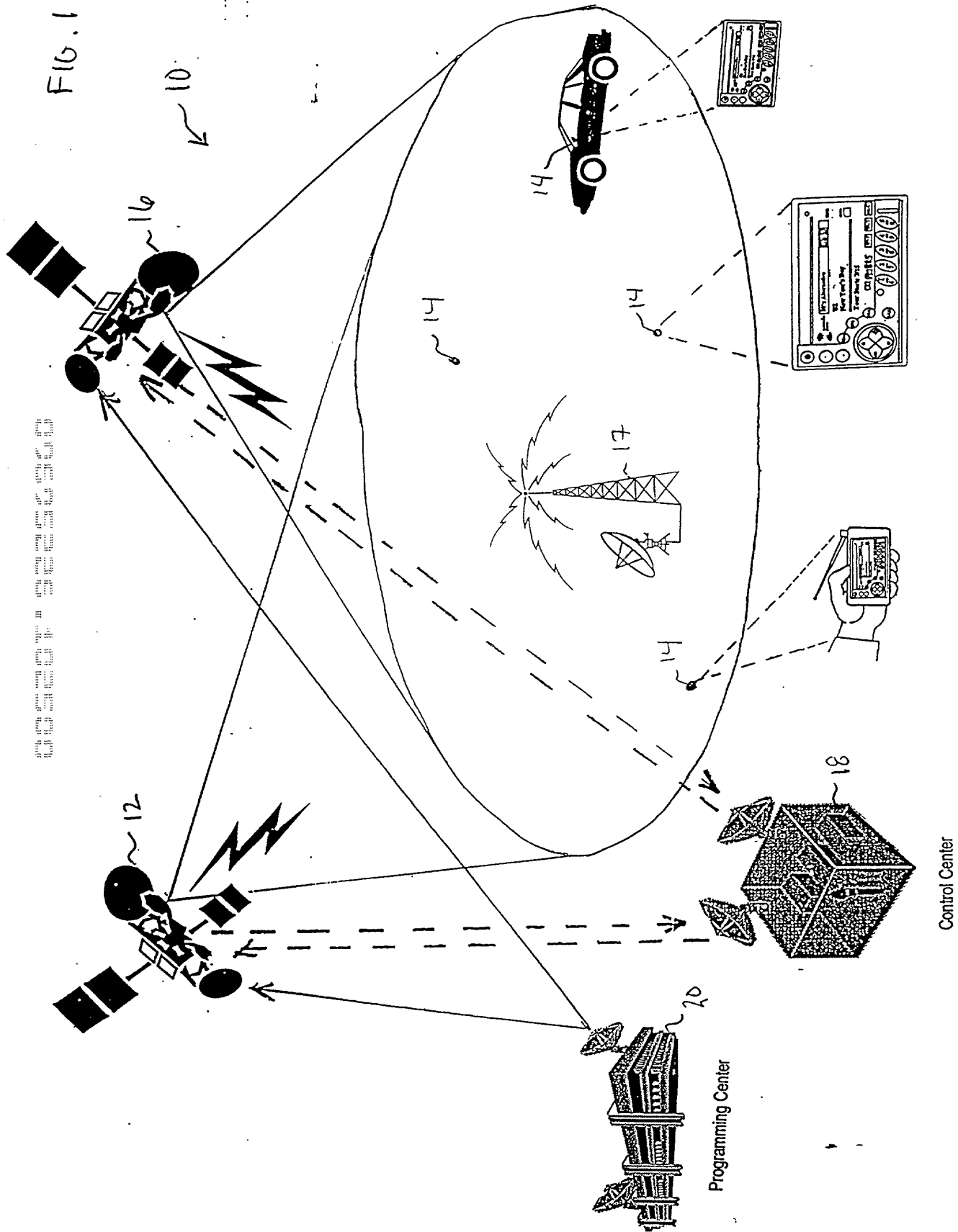


FIG. 2

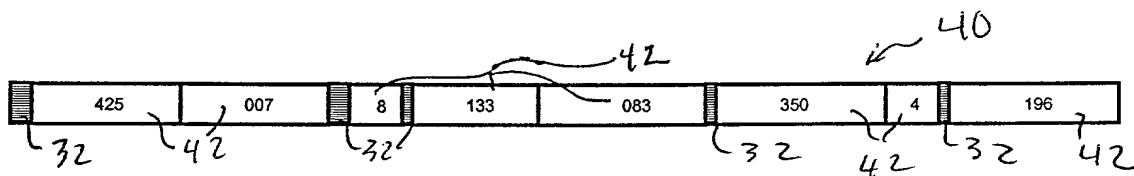
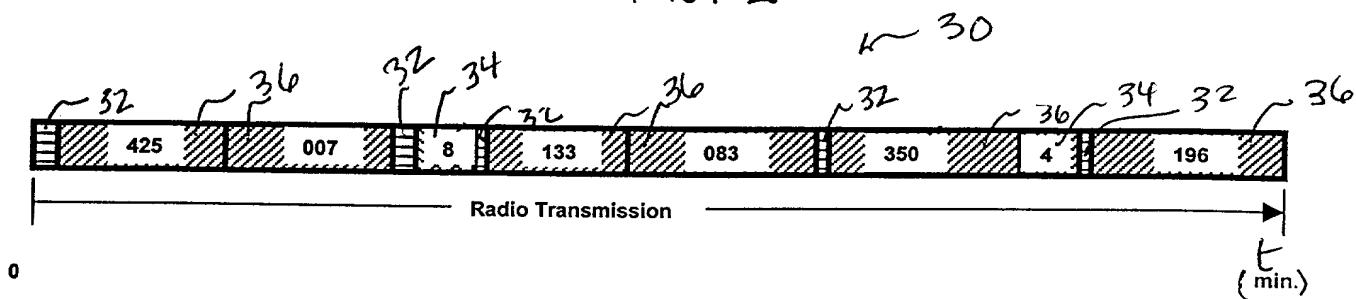


FIG. 3A



FIG. 3B



FIG. 3C

FIG. 5

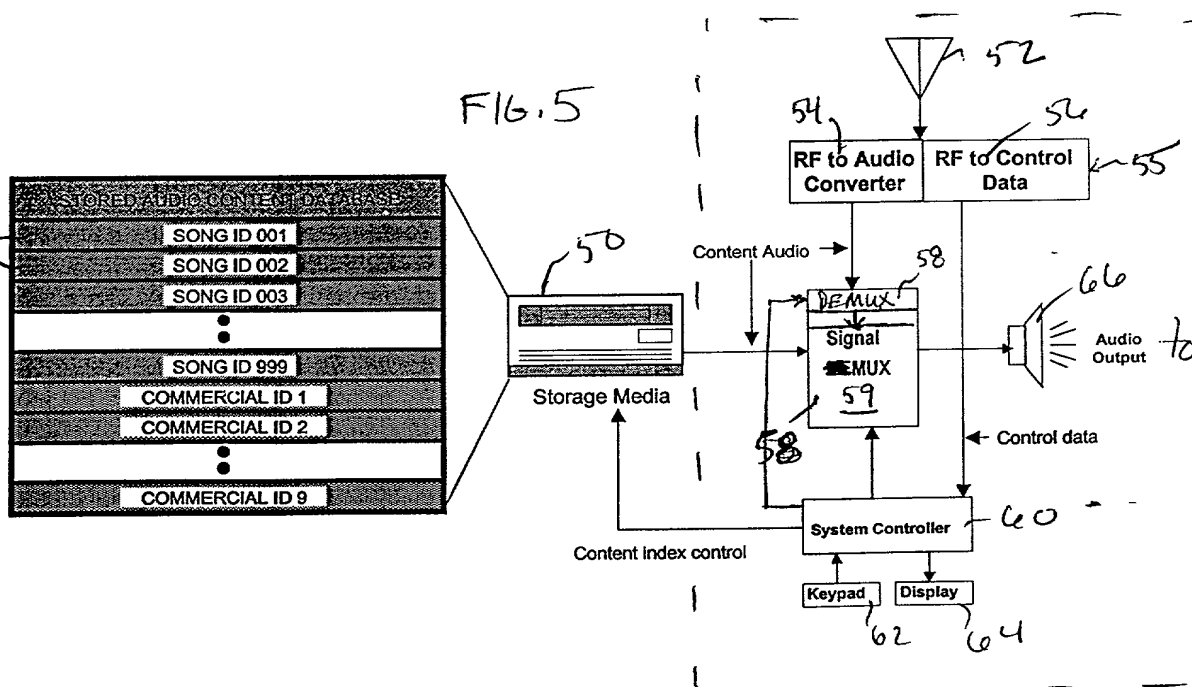


FIG. 4A

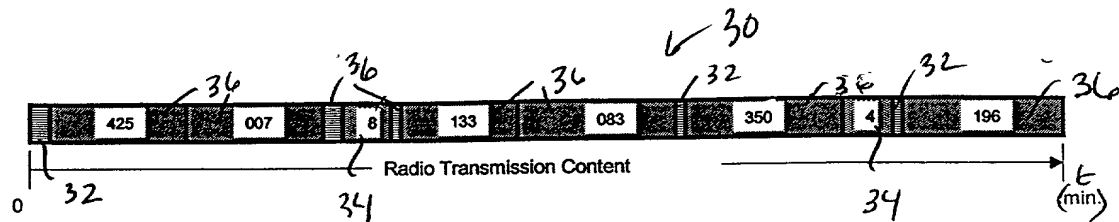


FIG. 4B

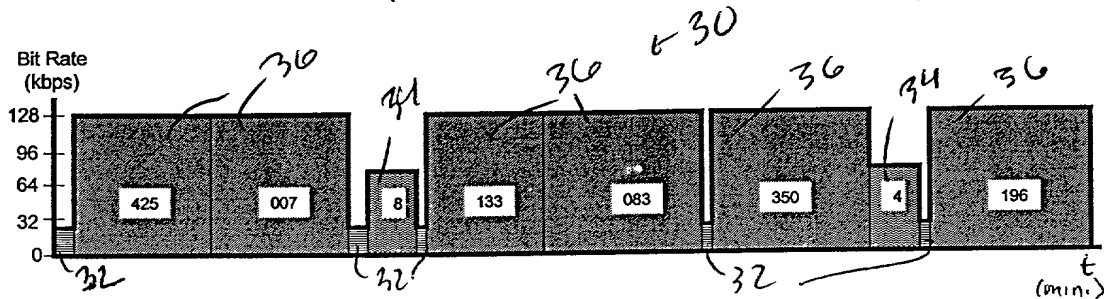


FIG. 4C

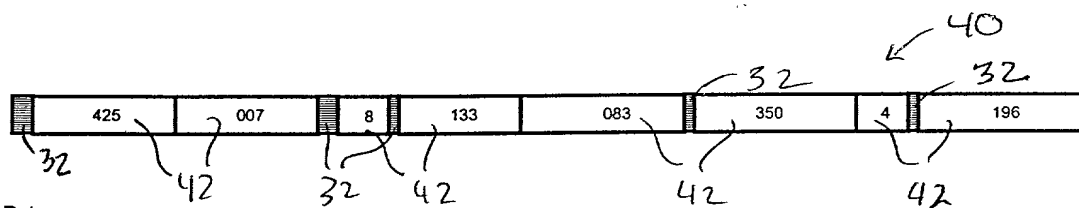


FIG. 4D

